

28. (New) A method for shaping surfaces, comprising:

using reactive atom plasma processing to shape and finish a surface.

29 (New) A method for shaping surfaces, comprising:

using reactive atom plasma processing to shape a surface while reducing the surface roughness.

Sub 31 30. (New) A method for shaping surfaces, comprising:

using reactive atom plasma processing for the damage-free shaping of a surface;

wherein said using step includes using a flow of auxiliary gas to effect the temperature of a flow of reactive gas before the reactive gas contacts the plasma.

Att 31. (New) A method for shaping surfaces, comprising:

generating an annular plasma;

injecting a flow of reactive gas into the center of the annular plasma; and

using reactive atom plasma processing to shape a surface.

#### Remarks

The above Amendments and these Remarks are in reply to the Office Action mailed July 8, 2002.

Claims 1-15 and 18-20 were pending in the Application prior to the outstanding Office Action. In the Office Action, the Examiner rejected claims 1-15 and 18-20. The present Response amends claims 1, 15 and 19, and adds new claims 21-31, leaving for the Examiner's present consideration claims 1-15, and 18-31. Reconsideration of the rejections and consideration of the new claims is respectfully requested.

#### I. Examiner Interview Summary

Attorney for Applicants conducted two separate phone interviews with the Examiner, on October 3, 2002 and October 7, 2002. In the interviews, potentially patentable distinctions between the present application and the cited art were discussed. Among these potentially patentable distinctions included

the concept of reactive atom plasma processing at about atmospheric pressure, the damage-free shaping of a surface, the smoothing of the surface in conjunction with shaping, the location of the reactive gas dissociation, the dissociation past the energy input zones, the temperature control of the reactive gas, the injection of a reactive gas into an annular plasma, and the absence of pre-mixing of the reactive and plasma gases. Various cited references were discussed with regard to these distinctions.

## **II. Rejections under 35 USC §112**

Claim 15 was rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 15 has been amended to correct a simple typographic error, to identify “(SF6)” as silicon hexafluoride. The claim was not amended for purposes related to patentability, and the scope of the claim is not intended to be changed. Applicants respectfully request that the rejection with respect to claim 15 be withdrawn.

Claim 19 was also rejected under 35 U.S.C. §112, second paragraph. Claim 19 has also been amended to correct a simple typographic error, to identify that method claim 19 is intended to depend from claim 1. As claim 1 is presently the single independent method claim, it would have been clear that claim 19 was intended to include all the limitations of at least claim 1. Therefore the amendment does not add new matter, but only clarifies that which was intended to be claimed. The claim was not amended for purposes related to patentability, and the scope of the claim is not intended to be changed. Applicants respectfully request that the rejection with respect to claim 19 be withdrawn.

## **III. Rejections under 35 USC §102**

Claims 1-4, 6, 7, 9-11 and 18-20 were rejected under 35 U.S.C. §102(b) as being anticipated by *Zarowin* (US 5,811,021). Claim 1 has been amended to recite the limitations of “creating an annular plasma having an energy input zone” and “injecting a reactive species into the annular plasma such that the reactive species dissociates primarily past the energy input zone.” *Zarowin* ‘021 does not disclose such limitations. As such, *Zarowin* ‘021 cannot anticipate claim 1. Claims 2-4, 6, 7, 9-11 and 18-20

depend from claim 1 and are therefore also not anticipated by *Zarowin* '021. Applicants therefore respectfully request that the rejection with respect to claims 1-4, 6, 7, 9-11 and 18-20 be withdrawn.

Claims 1, 3, 5-12 and 20 were rejected under 35 U.S.C. §102(b) as being anticipated by *Zarowin* Symposium 89. As discussed above, claim 1 has been amended to recite the limitations of "creating an annular plasma having an energy input zone" and "injecting a reactive species into the annular plasma such that the reactive species dissociates primarily past the energy input zone." *Zarowin* Symposium 89 does not disclose such limitations. As such, *Zarowin* Symposium 89 cannot anticipate claim 1. Claims 3, 5-12 and 20 depend from claim 1 and are therefore also not anticipated by *Zarowin* Symposium 89. Applicants therefore respectfully request that the rejection with respect to claims 1, 3, 5-12 and 20 be withdrawn.

Claims 1-11, 19 and 20 were rejected under 35 U.S.C. §102(b) as being anticipated by *Zarowin* (US 5,336,355). As discussed above, claim 1 has been amended to recite the limitations of "creating an annular plasma having an energy input zone" and "injecting a reactive species into the annular plasma such that the reactive species dissociates primarily past the energy input zone." *Zarowin* '355 does not disclose such limitations. As such, *Zarowin* '355 cannot anticipate claim 1. Claims 2-11, 19 and 20 depend from claim 1 and are therefore also not anticipated by *Zarowin* '355. Applicants therefore respectfully request that the rejection with respect to claims 1-11, 19 and 20 be withdrawn.

Claims 1, 2, 7, 9, 10 and 13 were rejected under 35 U.S.C. §102(b) as being anticipated by *Selwyn* (US 5,961,772). As stated by the Examiner, "*Selwyn* teaches generating a plasma with a CF<sub>4</sub>/Ar gas mixture." *Selwyn* does not disclose "creating an annular plasma having an energy input zone" and "injecting a reactive species into the annular plasma such that the reactive species dissociates primarily past the energy input zone," as set forth in amended claim 1. *Selwyn* cannot anticipate claim 1. Claims 2, 7, 9, 10 and 13 depend from claim 1 and are therefore also not anticipated by *Selwyn*. Applicants therefore respectfully request that the rejection with respect to claims 1, 2, 7, 9, 10 and 13 be withdrawn.

Claims 1-11, 13, 15 and 18-20 were rejected under 35 U.S.C. §102(b) as being anticipated by *Böhn* (DE 199 25 790 A1). *Böhn* does not disclose "creating an annular plasma having an energy input

zone” and “injecting a reactive species into the annular plasma such that the reactive species dissociates primarily past the energy input zone,” as set forth in amended claim 1. *Böhn* therefore cannot anticipate claim 1. Claims 2-11, 13, 15 and 18-20 depend from claim 1 and are therefore also not anticipated by *Böhn*. Applicants therefore respectfully request that the rejection with respect to claims 1-11, 13, 15 and 18-20 be withdrawn.

#### **IV. Rejections under 35 USC 103**

Claim 14 was rejected under 35 U.S.C. §103(a) as being unpatentable over *Selwyn* in view of *Collins* (US 6,068,784). As discussed above, claim 1 has been amended to recite the limitations of “creating an annular plasma having an energy input zone” and “injecting a reactive species into the annular plasma such that the reactive species dissociates primarily past the energy input zone.” *Selwyn* does not teach or suggest such limitations. *Collins* was cited by the Examiner as allegedly teaching that “CF<sub>4</sub> and C<sub>2</sub>F<sub>6</sub> are functionally equivalent as plasma etchants for silicon containing materials.” *Collins* does not, however, teach or suggest “creating an annular plasma having an energy input zone” and “injecting a reactive species into the annular plasma such that the reactive species dissociates primarily past the energy input zone.” Neither are such limitations taught by *Selwyn* and *Collins* in combination. As these limitations are neither taught nor suggested by the references, alone or in combination, claim 1 cannot be rendered obvious by *Selwyn* in view of *Collins*. As claim 14 depends from claim 1, neither can claim 14 be rendered obvious. Applicants therefore respectfully request that the rejection with respect to claim 14 be withdrawn.

Claim 14 is rejected under 35 U.S.C. §103(a) as being unpatentable over *Böhn* in view of *Collins* (US 6,068,784). As discussed above, claim 1 has been amended to recite the limitations of “creating an annular plasma having an energy input zone” and “injecting a reactive species into the annular plasma such that the reactive species dissociates primarily past the energy input zone.” As discussed above, neither *Böhn* nor *Collins* teach or suggest such limitations. Neither are such limitations taught by *Böhn* and *Collins* in combination. As these limitations are neither taught nor suggested by the references, alone or in combination, claim 1 cannot be rendered obvious by *Böhn* in view of *Collins*. As claim 14 depends

from claim 1, neither can claim 14 be rendered obvious. Applicants therefore respectfully request that the rejection with respect to claim 14 be withdrawn.

#### **V. Newly Added Claims**

Claims 21-31 have been added to more particularly point out and distinctly claim the subject matter which Applicants regard as the invention. These claims are supported by the specification and do not add new matter to the disclosure. Applicants respectfully request that the new claims be considered.

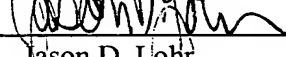
#### **VI. Conclusion**

In light of the above, it is respectfully submitted that all of the claims now pending in the subject patent application should be allowable, and a Notice of Allowance is requested. The Examiner is respectfully requested to telephone the undersigned if he can assist in any way in expediting issuance of a patent.

The Commissioner is authorized to charge any underpayment or credit any overpayment to Deposit Account No. 06-1325 for any matter in connection with this response, including any fee for extension of time, which may be required.

Respectfully submitted,

Date: October 8, 2002

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## APPENDIX

### In the Claims:

1. (Once amended) A method for shaping surfaces, comprising: [the steps of]  
creating an annular plasma having an energy input zone;  
injecting a reactive species into the annular plasma such that the reactive species dissociates  
primarily past the energy input zone; and  
using reactive atom plasma processing for the damage-free shaping [damage free surfaces] of  
a surface.
15. (Once amended) The method of claim 1 using silicon [hexafluorine] hexafluoride (SF<sub>6</sub>) in argon to create the plasma.
16. Withdrawn.
17. Withdrawn.
19. (Once amended) The method of claim 1 for removing damage introduced by previous process steps.
21. (New) A method for shaping surfaces, comprising:  
using reactive atom plasma processing to shape and polish a surface.
22. (New) A method for shaping surfaces, comprising:  
using reactive atom plasma processing for the damage-free shaping of a surface at about  
atmospheric pressure.

23. (New) A method for shaping surfaces, comprising:  
using reactive atom plasma processing for the damage-free shaping of a surface;  
wherein said using step includes using a flow of auxiliary gas to effect a flow of reactive gas  
before the reactive gas contacts the plasma.
24. (New) A method for shaping surfaces, comprising:  
generating an annular plasma;  
injecting a flow of reactive gas into the center of the annular plasma; and  
using reactive atom plasma processing to shape a surface at atmospheric pressure.
25. (New) A method for shaping surfaces, comprising:  
creating an plasma having a central zone;  
injecting a reactive species into the central zone of the plasma such that the reactive species  
dissociates after entering the plasma; and  
using reactive atom plasma processing for the damage-free shaping of a surface.
26. (New) A method for shaping surfaces, comprising:  
creating a plasma a distance from the tip of a plasma torch, the plasma having a skin;  
injecting a flow of reactive gas through the skin of the plasma such that the reactive species  
begins to dissociate; and  
using reactive atom plasma processing for the damage-free shaping of a surface.
27. (New) A method for shaping surfaces, comprising:  
creating a plasma having an energy input zone;  
injecting a reactive species into the plasma such that the reactive species dissociates primarily  
past the energy input zone; and

using reactive atom plasma processing for the damage-free shaping of a surface.

28. (New) A method for shaping surfaces, comprising:

using reactive atom plasma processing to shape and finish a surface.

29 (New) A method for shaping surfaces, comprising:

using reactive atom plasma processing to shape a surface while reducing the surface roughness.

30. (New) A method for shaping surfaces, comprising:

using reactive atom plasma processing for the damage-free shaping of a surface;

wherein said using step includes using a flow of auxiliary gas to effect the temperature of a flow of reactive gas before the reactive gas contacts the plasma.

31. (New) A method for shaping surfaces, comprising:

generating an annular plasma;

injecting a flow of reactive gas into the center of the annular plasma; and

using reactive atom plasma processing to shape a surface.